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# **Brain activity underlying successful memory retrieval: A comparison of young and older adults**



**Gaby Pfeifer**

# Project in a nutshell...

- We use *functional magnetic resonance imaging (fMRI)* to investigate brain activation and connectivity whilst participants lie in an MRI-scanner and perform a visual associative memory test.

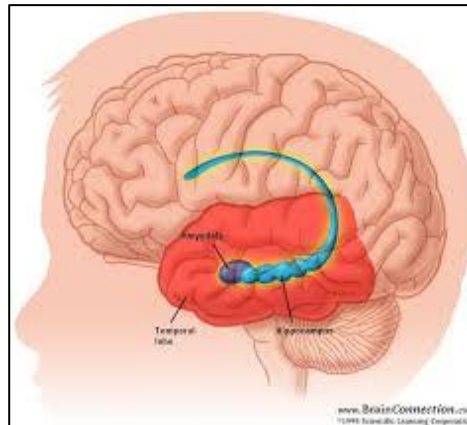


# This presentation

- Age-differences in the hippocampal – neocortical connectivity during memory retrieval.

**Participants:** 19 young adults (21 – 32 years of age;  $M = 24.32$ )  
19 older adults (59 – 81 years of age;  $M = 66.21$ )

- **Hippocampus:** - implicated in memory retrieval  
- acts as a collector of information from the neocortex  
(Diana et al., 2007; Montaldi and Mayes, 2010; Squire and Wixted, 2011).

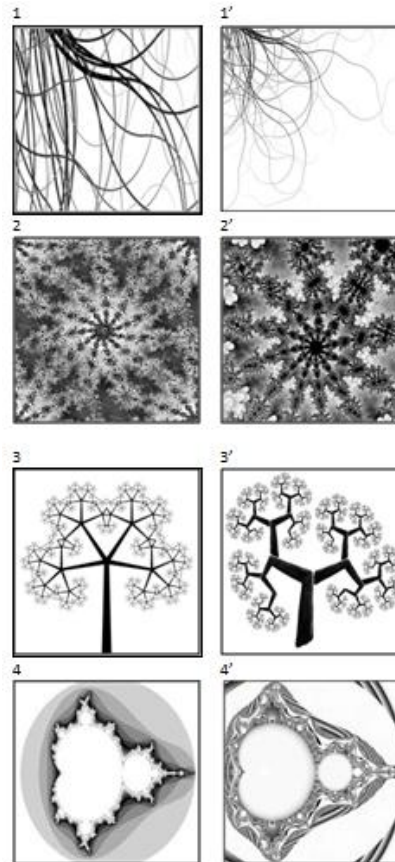


# Associative memory task

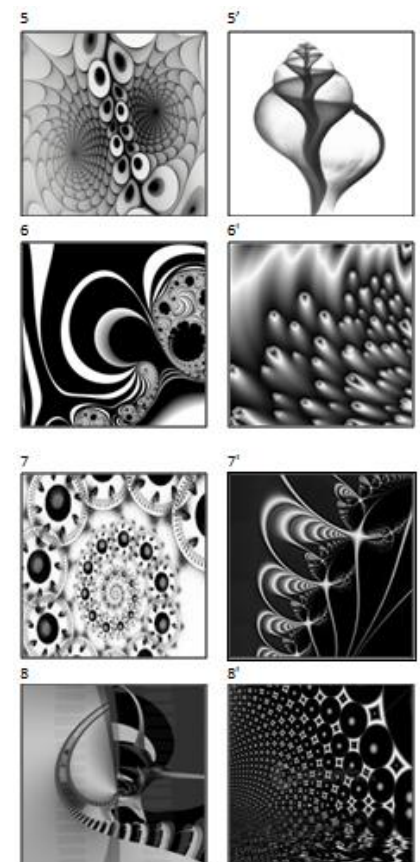
## Stimuli

- 8 achromatic pair-associates were learned to 87.5% performance criterion prior to scanning.

**Similar pairs**  
**= low memory load**



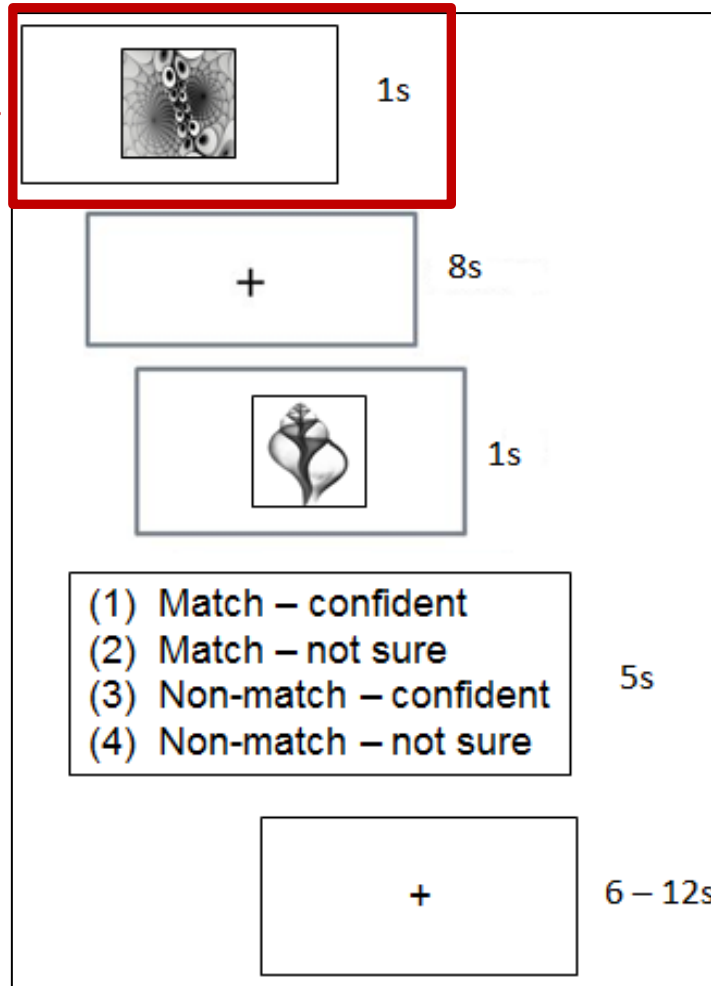
**Dissimilar pairs**  
**= high memory load**



# Procedure

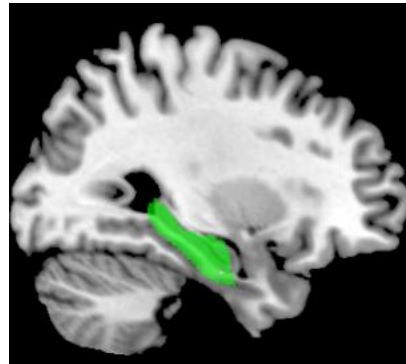
**In the MRI-scanner: Delayed pair-associative retrieval task**

\*Only correct and confident responses during cue period were included in the analyses.



# Connectivity analyses

- Seed Region: left Hippocampus.



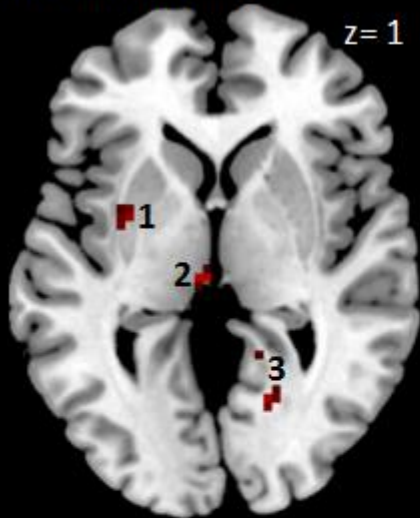
- Exploratory seed-to-voxel regression for each group/condition.
- Regression of the average activation of the Hippocampus with every other voxel in the brain.

# Connectivity Results

- YOUNG > OLDER adults:

Low memory load

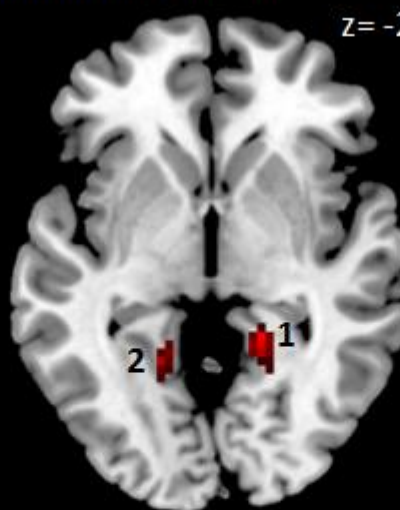
z = 1



- 1) L Putamen
- 2) L Thalamus
- 3) R Parahippocampal Gyrus

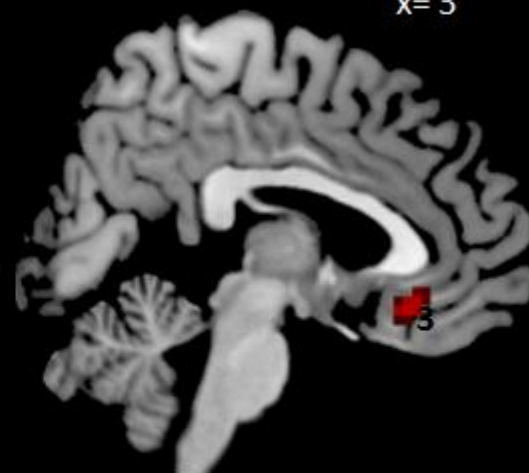
High memory load

z = -2



- 1) R Lingual Gyrus
- 2) L Fusiform Gyrus

x = 3



- 3) R Middle Orbital Gyrus

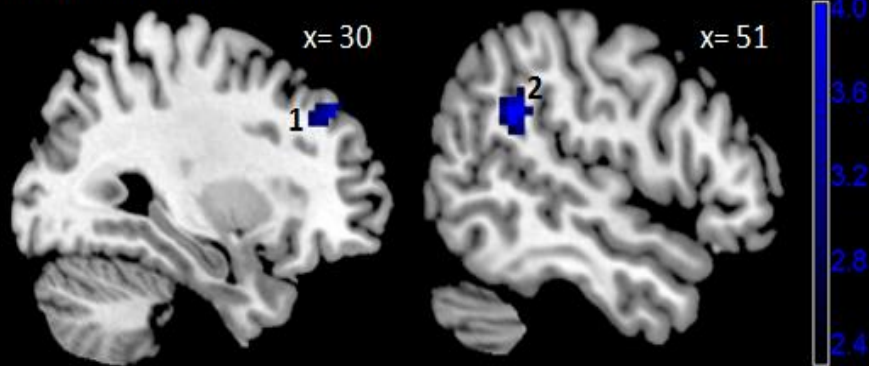
All images are shown at a height threshold of  $T > 2.72$ ;  $p = 0.005$  (uncorrected), with an extent threshold of 5 voxels. The images were masked with the left hippocampus.



# Connectivity Results

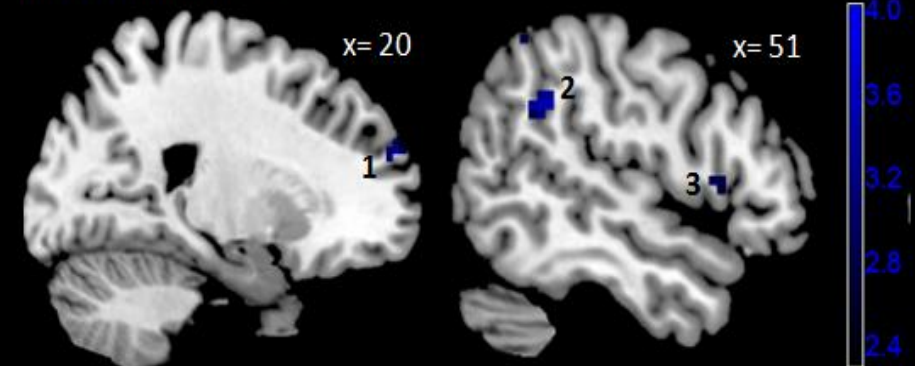
- **OLDER > YOUNG adults:**

Low memory load



- 1) R Middle Frontal Gyrus
- 2) R Supramarginal Gyrus

High memory load



- 1) R Superior Frontal Gyrus
- 2) R Supramarginal Gyrus
- 3) R Inferior Frontal Gyrus

All images are shown at a height threshold of  $T > 2.72$ ;  $p = 0.005$  (uncorrected), with an extent threshold of 5 voxels. The images were masked with the left hippocampus.

# Summary

- **Older adults** have an altered resource allocation, involving hippocampal connectivity with a frontal-parietal control network, even when memory load is low.
- **Young adults** show greater network flexibility from low to high task demands.

# Conclusion

- Brain imaging can reveal age-related changes that are undetectable with behavioural measures.
- Knowledge about network-changes in older adults can be used to inform cognitive interventions.
- E.g. Teaching explicit associative memory strategies, such as using perceptual cues and visual imagery (Hampstead et al., 2011) to re-engage a memory-related rather than executive control-related network.

# Acknowledgements

**Dr Natasha Sigala**



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**Dr Dennis Chan**

